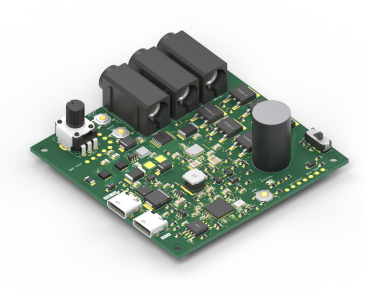
BLDC Motor Controller

1.1 Description

A USB-C Power Delivery controller for three-phase brushless DC motors. The computer uses a dedicated data port to select a supply voltage, arm the driver and start a timed run.



Controller assembly

1.2 Device specifications

Parameter	Specification
Motor type	Three-phase brushless DC
Controller	RP2040 with MCT8329A motor driver
Power and data	USB-C Power Delivery input and separate USB-C data port
Motor connection	Three 4 mm sockets, U/V/W
PCB	73 × 72 mm, four copper layers
Enclosure	Included; approximately 85.6 × 84.6 mm footprint

1.3 Using the board

Secure the motor with the propeller removed. Disconnect motor power before wiring U, V and W. Connect the computer to J1 DATA and a compatible PD supply to J19. Open the BLDC dashboard, select a supported voltage, then arm the drive before starting a run.

Device guide

2 Protocol reference

115200 baud USB CDC; newline-delimited JSON, maximum 511 bytes per incoming line. Oversized lines are discarded through the next newline. Responses use `protocol: "bldc-1"`; telemetry also includes `firmware: "native-bldc"`.

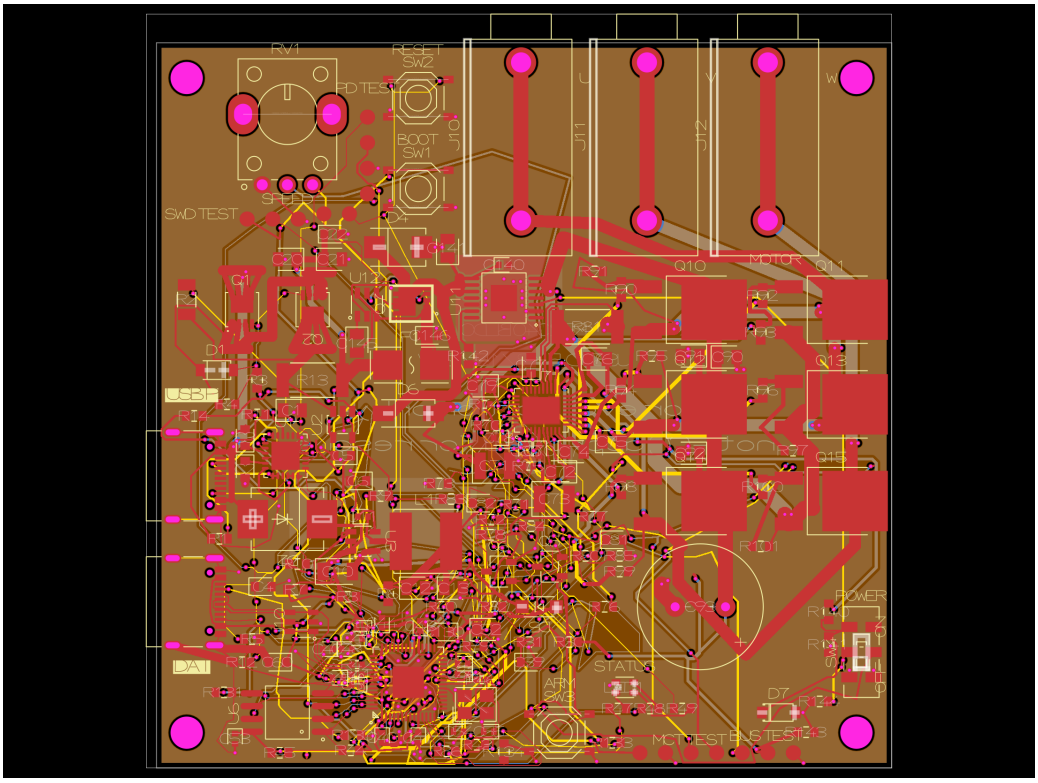
Commands with an integer `id` receive `{ "type": "ack", "protocol": "bldc-1", "id": 1, "ok": true, "error": "" }`. Heartbeats do not receive ACKs. Plain diagnostic lines may be interleaved with JSON; clients ignore them.

Command and fields	Behavior
hello	stop/disarm, open a new browser session, invalidate the old heartbeat.
heartbeat	maintain that session, recommended every 300 ms; timeout 1000 ms.
status	request live telemetry without altering motion.
set_pd_voltage, voltage	5|9|15|20`: request/verify the selected RAM-only 2 A contract; automatically stops/disarms before negotiating.
arm	verify/apply the RAM profile at the selected voltage with live heartbeats. It expires in 30 seconds or on power/connection loss.
start, percent	0..100`, `duration_ms: 0 or 100..60000`, optional `direction: 1|-1`: explicit timed run; requires prior fresh arming. Duration is a whole number of milliseconds.
set_speed, percent	0..100`: adjust the reference while running without extending its deadline.
stop	stop/disarm and clear the software LED fault latch.

Speed is a digital drive reference. The reported electrical frequency is distinct from shaft RPM.

3 Mechanical information

3.1 Assembly and mounting



Component-side PCB layout from the v0.3.100 design. Dimensions in the text below.

3.2 Installation dimensions

The PCB is 73 × 72 mm. Four Ø3.2 mm holes form a 66.5 × 65 mm center-to-center pattern. In the board coordinate system, their centers are at X = −37 and 29.5 mm, Y = −23 and 42 mm.

The included enclosure occupies approximately 85.6 × 84.6 mm. Leave access to J1 DATA, J19 PD, the power switch and all three motor sockets.

3.3 Design resources

Device guide · **Protocol specification** · **PCB design**